COLORADO RIVER RECOVERY PROGRAM **Project No.: 22j**
FY-2002 PROPOSED SCOPE-OF-WORK for:
Lower Green River Colorado Pikeminnow Population Estimate

Lead Agencies: Larval Fish Laboratory, CSU, Utah Division of Wildlife Resources, U.S. Fish and Wildlife Service
Jointly Submitted by: Larval Fish Laboratory, CSU, Utah Division of Wildlife Resources, U.S. Fish and Wildlife Service

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Category (check one):
_x_ Ongoing project
__ Requested new start
__ Unsolicited project
__ Outside funding

Expected Funding Source:
_x_ Annual funds
___ Capital funds
___ Other (explain)

Date: August 2, 2000
Revised Date: September 13, 2000, September 24, 2001, November 30 2001

I. Title: **Population estimates of Colorado pikeminnow in the Lower Green River.**

II. Relationship to Recovery Program/Ranking Factors:

Green River Action Plan: Mainstem

V. Monitor populations and habitat and conduct research to support recovery actions (research, monitoring, and data management)

V.C. Population estimate for Colorado pikeminnow

V.C.2. Lower Green River

III. Study Background/Rationale:

Colorado pikeminnow are widely distributed throughout the Green River, the result of high mobility and environmental tolerances (Muth *et al.* 1999). In the Green River, they range from the confluence of the Colorado River upstream to the upper reaches of Lodore Canyon (Tyus *et al.* 1982, Bestgen and Crist 2000). Although numbers of Colorado pikeminnow were severely depressed following construction of Flaming Gorge Dam (Tyus 1991), recruitment has increased since the reoperation of dam following 1988 (McAda et al. 1997). Recently, the Biology Committee of the RIP decided that ISMP data will shift to the determination of population estimates per river, rather than relative density in selected river reaches. This new direction will be in alignment with recovery goals being developed by the RIP for down- and delisting criteria. Currently a cooperative study between CSU, UDWR and the FWS is underway to estimate the population size of Colorado pikeminnow in the upper Green River subbasin (Yampa, Green and White rivers). This proposal, together with the ongoing scope of work, will provide an estimate of the Colorado pikeminnow occupying the entire Green River subbasin.

Information on catch per unit effort, size frequency, and spawning locations is available for Colorado pikeminnow (Tyus 1986, 1990, McAda *et al.* 1996, 1997), but minimal information is available on population estimates of pikeminnow. Using a variety of approximations, Tyus (1991) estimated that approximately 8,000 Colorado pikeminnow occupied the Green River subbasin. More recently, Crowl and Bouwes (1997) estimated the population of Colorado pikeminnow in the Green River subbasin to be 2,400 fish, whereas, Nesler (2000) estimated the same population to be between 5,000 and 8,000 fish. To determine a valid population estimate, a specific effort with an appropriate design needs to be completed that satisfies the assumption of the estimator. These abundance estimates will provide important information on the population status and progress toward the recovery of the Colorado pikeminnow.

IV. Study Goals, Objectives, End Product:

Goal: Obtain a reasonable (confidence intervals of less than 20%) estimate of the adult population abundance and survival of Colorado pikeminnow occupying the lower Green River study area.

Objectives:

1. Use a three pass capture effort to estimate the number of Colorado pikeminnow 250 mm TL in the lower Green River between the confluence of the White River (RM 246.0) to the confluence of the Colorado River (RM 0).

2. Maximize captures of Colorado pikeminnow by sampling intensively within concentration habitats and sampling shorelines between concentration habitats.

3. Obtain estimates of probability of capture and abundance for Colorado pikeminnow for the study area.

4. Evaluate assumption of mixing of Colorado pikeminnow among concentration habitat and adjoining habitat by redistributing all fish captured to their approximate capture locations.

End Product:

A report estimating population size and survival of sub-adult and adult Colorado pikeminnow in the lower Green River.

An annual summary report including the summary of first year results and the abundance estimate for the first year will be submitted December 2001. A list of pittagged fish will be submitted to the database manager at the end of each year.

V. Study area:

The study area will be the lower Green River from RM 0.0-246.0. The sampling area will range from the White River confluence downstream to the Colorado River confluence. The lower Green River will be divided into two sections. The first section will be from the White River confluence downstream to Tusher Wash Diversion (RM 127.5) above the town of Green River, Utah. The second section will be from RM 127.5 to the Colorado River confluence (RM 0).

VI. Study methods/approach:

The approach taken in capturing and marking Colorado pikeminnow will be a cooperative approach similar to the ongoing effort in the middle Green River between the Utah Division of Wildlife Resources and the U.S. Fish and Wildlife Resources. The upper portion of the study area (RM 246-127.5) will be sampled by the U.S. Fish and Wildlife Service and the lower reach from RM 127.5 to the confluence of the Colorado River will be sampled by the Utah Division of Wildlife Resources.

Data Collection

We propose to use a sampling design similar to that being used to estimate the abundance of Colorado pikeminnow in the middle Green River (RIP project Abundance estimates for Colorado pikeminnow in the middle Green River/Yampa River system). However it should be noted, the first year of sampling will be considered a pilot study. Three pass sampling will be conducted in the fall after the spawning period (mid-September to late October). Three sample passes will be made through the lower Green River (RM 246-0) using electrofishing boats, trammel nets, or a combination of both techniques to capture Colorado pikeminnow. After an entire pass through the study area, investigators will begin again at the top. A sufficient amount

of time (e.g., 7-10 days) should elapse between the start of consecutive sampling occasions to allow for sufficient mixing of marked and unmarked fish. In the appropriate reaches, *ISMP* will also be used.

In an attempt to achieve the highest capture rates and reduce the time required to complete a single pass, most sampling effort will be conducted in areas where the fish concentrate, such as eddies, pools, flooded tributary mouths, and backwaters. All pikeminnow captured will be examined for PIT tags, weighed, and total length recorded; those fish 250 mm TL (includes sub-adult and adult) without tags will be PIT-tagged and released. The capture and release site will be identified using a GPS (global positioning system) unit. Descriptions of macrohabitat (modified from Tyus *et al.* 1984) at each capture/release location will be recorded. Length frequency histograms will be developed to provide a representation of the various size classes present and to identify the dominate size class present in the lower Green River and each section each year. The capture-recapture histories will allow the use of robust designs to estimate population size, survival, recruitment, and to evaluate assumptions (e.g., heterogeneity in capture probabilities).

Data Analysis

The primary method for making abundance estimates comes from closed population models (e.g., CAPTURE, White *et al.* 1982; Osmundson and Burnham 1998). This class of models assume: 1) the population is closed geographically and demographically (i.e., no immigration, emigration, mortality, or recruitment during the capture-recapture study); 2) all individuals in the population have an equal probability of capture on a given sample pass; and 3) marked animals can be distinguished from unmarked. We believe these assumptions for the most part will be met. The first assumption, population closure, will be met because sampling will occur over the known distribution of the population and during limited time period (approximately 50 d). The second assumption, equal probability of capture, is the most difficult to meet. Probability of capture can vary among sample passes, but for single pass, probability will probably vary among individuals because of varying size or habitats occupied. However, analysis techniques are available that can help in dealing with this heterogeneity. Finally, we feel comfortable that the assumption that PIT tagged fish can be readily identified will be met by carrying duplicate PIT tag scanners into the field. Furthermore, we have much experience that PIT tags are rarely lost from adult fish.

Estimates of survival and recruitment can be made using open population models, called Jolly-Seber models (Jolly 1965, Seber 1965, Burnham *et al.* 1987, Lebreton *et al.* 1992, Osmundson and Burnham 1998). These models would use the capture-recapture data obtained at yearly intervals.

After the first year of sampling, more efficient designs may be discovered, based on fish distribution, type of gear, and time it takes to sample each section. Consultation with a capture-recapture statistician (e.g. Gary Anderson or Ken Burnham at Colorado State University) would be valuable. The statistician could direct us to the most appropriate models for population expansion, robust and efficient design. In addition, data from the first will allow us to determine if we can estimate the number of Colorado pikeminnow (250 mm TL) in the two reaches of the

lower Green River within 20 percent of the point estimate at the 95 percent confidence level. Therefore after consultation and the review of the data, modifications to our sampling design will be pursued, if necessary, such as randomly or systematically selecting (subsampling) sites within the 246 mile area; or concentrate our efforts on one section only and possibly increasing the number of the passes to four in that section.

VII. Task description and schedule:

Task 1. Three sample passes through section 1 (confluence with White River to Tusher Wash Diversion) using 2 electrofishing boats (or rafts in Desolation-Gray canyons), and marking and recapturing Colorado pikeminnow 250 mm TL; complete task within 50 days after starting. Sampling will occur from mid-March to mid-May.

Task 2. Three sample passes through section 2 (Tusher Wash Diversion to confluence with Colorado River) using 2 electrofishing boats, and marking and recapturing Colorado pikeminnow 250 mm TL; complete task within 50 days after starting. Sampling will occur from mid-March to mid-May.

Task 3. After first year, analyze data, consult with statistician, and alter sampling design if necessary.

Task 4. Data entry, data analysis, consult with statistician, write annual report.

Task 5. Sampling team coordination, data entry, and analysis.

Task 6. Completion of final report

Study Schedule:

Task Description and Schedule FY-2002
Task 1,2 August September 3-pass sampling.
Task 3-5 December 2002. Submit annual summary report.

Task Description and Schedule FY-2003
Task 1,2 August September 3-pass sampling.
Task 3-5 December 2003. Submit annual summary report.

Task Description and Schedule FY-2004
Task 5,6 Submit Draft final report July 2004.

VIII. FY2002 Work:

1. Deliverables/due dates: Annual Report December 15, 2002

2. FY 2002 Budget

Tasks 1-4 for White R.to Green River reach (FWS)		
Labor (2 biologists for 2 mos; 3 techs for 2 mos)		$ 35.2K
Travel		6.6K
Supplies & Equipment		13.2K
Other		0.5K
Total		$ 55.5K
Task 1-4 for Green River to Colo. R reach (UDWR)		
Labor		
2 Biologists	136 days	$ 34.9K
5 Technicians	300 days	34.6K
Project Leader	19 days	2.6K
		$ 72.1K
Travel		
Mileage		$ 7.2K
Food		3.6K
Gas (boats)		1.2K
		$ 12.0K
Supplies & Equipment		$ 12.0K
Other		$ 2.4K
Total -		$ 98.5K
Task 4-5 for Statistical Assistance (LFL, CSU)		
Labor		$ 13.0K
Travel		1.5K
Total		$ 14.5K
Grand Total		$168.5K

3. FY 2003 Budget

Tasks 1-4 for White R.to Green River reach (FWS)	
Labor (2 biologists for 2 mos; 3 techs for 2 mos)	$ 37.0K
Travel	6.6K
Supplies & Equipment	13.2K
Other	1.3K
Total	$ 58.1K

Task 1-4 for Green River to Colo. R reach (UDWR)			
Labor			
	2 Biologists	136 days	$ 36.6K
	5 Technicians	300 days	36.3K
	Project Leader	19 days	2.8K
			$ 75.9K
Travel			
	Mileage		$ 7.2K
	Food		3.6K
	Gas (boats)		1.2K
			$ 12.0K
Supplies & Equipment			$ 12.7K
Other			$ 2.4K
Total -			102.8K
Task 4-5 for Statistical Assistance (LFL, CSU)			
Labor			$ 14.0K
Travel			2.0K
Total			$ 16.0K
Grand Total			$176.9K

IX. Budget Summary:

FY2002	$168.5K
FY2003	$176.9K
FY2004	$ 50K

[1] Supplies and equipment includes equipment maintenance, supplies, waders, etc.,.
* Does not include BR-FWS transfer overhead costs

X. Reviewers:

XI. References:

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